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Sediment Quantity in the San Luis Drain

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The purpose of this aspect of the Grassland Bypass Project Monitoring Program (Monitoring Program) is to determine the changes in quantity and movement of sediment in the San Luis Drain (SLD). This is accomplished by actual measurement of the bed sediment and using total suspended solids measurements at the inlet and outlet of the SLD.

Sediment Quantity Monitoring Performed by the San Luis and Delta-Mendota Water Authority

Section 11.4 of the Compliance Monitoring Program Phase II (USBR et al., 2001) describes the procedure to measure the quantity of sediment in the SLD. The 2001 Monitoring Program procedure for sediment quantity measurement is somewhat different from the Phase I Monitoring Program (USBR et al., 1996). The revised procedure requires two sediment depth measurement at each location; one on either side of the SLD. These two measurements are used to establish an average depth of sediment above SLD invert so that the volume of total sediment may be estimated.

The Monitoring Program calls for the measurement of sediment in four reaches of the SLD (Reaches 1, 10, 14, and 17). Measurements of sediment depths were to be made using the Monitoring Program protocol. The

locations of the sediment measurement points duplicated those of the March of 1987 survey performed by Summers Engineering. The Monitoring Program calls for measurements to be made once per year.

The sediment in the SLD was measured in all 19 reaches of the Grassland Bypass Project (GBP) which included the four required reaches. Measurements were made in accordance with the Monitoring Program. The results are reported by reach in comparison to the March 1987, 1997, 1998, 1999, and 2000 surveys.

Table 1 summarizes the results. The results are also shown graphically in Figure 1. The results indicate that there is a net increase of 21,400 cubic yards from August 2000 to November 2001, compared to a net increase of 25,700 cubic yards from July 1999 to August 2000. A total of 75,200 cubic yards of sediment has accumulated in the SLD since 1997.

Survey measurements indicated that individual reaches of the SLD gained a maximum of 6,400 cubic yards (Pool 16), and lost a maximum of 300 cubic yards (Pool 12) as compared to the 2000 sediment survey. The average depth of sediment throughout the SLD was 2.3 feet, with a maximum depth of 6.4 feet measured in Pool 15.

In general, sediment accumulation is occurring in the first 5 reaches (Pools 18 to 14), as the suspended solids drop out of the water column upon entering the SLD. The water velocity within the SLD is kept below 1 foot per second to prevent the suspension of material from the sediment bed. The slower velocity also increases the rate at which suspended solids drop out of the water column.

**Table 1. 2001 San Luis Drain Sediment Survey
Survey Summary and Comparison**

Pool	Checks	Distance (miles)	March 1987		June-Sept. 1997		July 1998		July 1999		August 2000		November 2001	
			Volume (cu yd)	Vol / mile (cu yd/mi)	Volume (cu yd)	Vol / mile (cu yd/mi)	Volume (cu yd)	Vol / mile (cu yd/mi)	Volume (cu yd)	Vol / mile (cu yd/mi)	Volume (cu yd)	Vol / mile (cu yd/mi)	Volume (cu yd)	Vol / mile (cu yd/mi)
End	End to 1	2.64	3,176	1,203	1,697	643	2,795	1,059	3,602	1,364	4,451	1,686	5,611	2,125
1*	1 to 2	1.82	2,567	1,410	1,840	1,011	3,375	1,854	4,514	2,480	5,306	2,915	5,487	3,015
2	2 to 3	0.28	1,059	3,781	531	1,896	955	3,411	872	3,114	836	2,986	1,748	6,242
3	3 to 4	2.57	4,909	1,910	3,350	1,304	4,839	1,883	3,244	1,262	5,582	2,172	6,404	2,492
4	4 to 5	1.8	4,440	2,467	6,521	3,623	9,049	5,027	6,760	3,756	8,968	4,982	9,836	5,465
5	5 to 6	2.06	4,242	2,059	4,370	2,121	4,596	2,231	4,139	2,009	5,679	2,757	6,481	3,146
6	6 to 7	0.83	2,160	2,602	2,584	3,113	2,432	2,930	1,762	2,123	2,416	2,910	2,321	2,797
7	7 to 8	0.45	3,935	8,744	3,278	7,285	3,135	6,967	3,099	6,887	3,068	6,817	2,842	6,315
8	8 to 9	0.47	907	1,931	816	1,736	778	1,655	627	1,334	1,420	3,022	1,600	3,404
9	9 to 10	3.2	6,963	2,176	6,390	1,997	8,571	2,678	4,632	1,448	8,797	2,749	9,364	2,926
10*	10 to 11	1.46	2,647	1,813	2,708	1,855	2,781	1,905	3,101	2,124	3,669	2,513	3,835	2,626
11	11 to 12	2.5	4,835	1,934	4,947	1,979	7,620	3,048	6,499	2,600	10,194	4,078	10,900	4,360
12	12 to 13	0.46	784	1,705	909	1,977	1,504	3,270	629	1,367	2,274	4,942	1,966	4,273
13	13 to 14	0.91	2,038	2,240	1,771	1,946	2,657	2,920	2,709	2,977	3,835	4,215	4,378	4,811
14*	14 to 15	1.34	2,304	1,719	3,803	2,838	5,427	4,050	12,030	8,978	11,466	8,557	14,917	11,132
15	15 to 16	0.96	1,822	1,898	2,700	2,813	6,456	6,725	11,699	12,186	15,420	16,062	18,661	19,438
16	16 to 17	1.68	5,863	3,490	7,605	4,527	10,482	6,239	12,895	7,676	14,691	8,745	21,132	12,578
17*	17 to 18	0.68	1,885	2,772	3,006	4,420	2,435	3,581	3,205	4,713	3,477	5,113	4,900	7,206
18	18 to 19	0.97	1,558	1,607	1,768	1,822	2,519	2,597	2,603	2,684	2,819	2,906	3,427	3,533
Totals		27.08	58,094		60,594		82,406		88,621		114,368		135,809	
Averages				2,145		2,238		3,370		3,741		4,744		5,678

* Required by Grassland Bypass Monitoring Program

Total Suspended Solids Measurements

The Monitoring Program calls for total suspended solids (TSS) measurements as part of the water quality monitoring. These measurements were to be taken just downstream of the inlet to the SLD (Site A) and just upstream of the outlet (Site B). Measurements were taken on a weekly basis at these sites. The monthly average data are shown for WY 1997 to WY 2001 in Table 2. Overall, the WY 2001 data show that TSS concentrations at Site A are higher than at Site B by a factor of 2.3, averaged over the water year. One commitment of the GBP was to minimize flows so as to not cause sediment movement or suspension of sediments from the bottom of the SLD. The data suggest that the suspended sediments are settling in the SLD and that there is no net movement or suspension of sediments.

References

- U.S. Bureau of Reclamation et al. 2001. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project, Phase II, March 2002. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.
- U.S. Bureau of Reclamation et al. 1996. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project, September 1996. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

Figure 1. San Luis Drain Sediment Survey Comparison

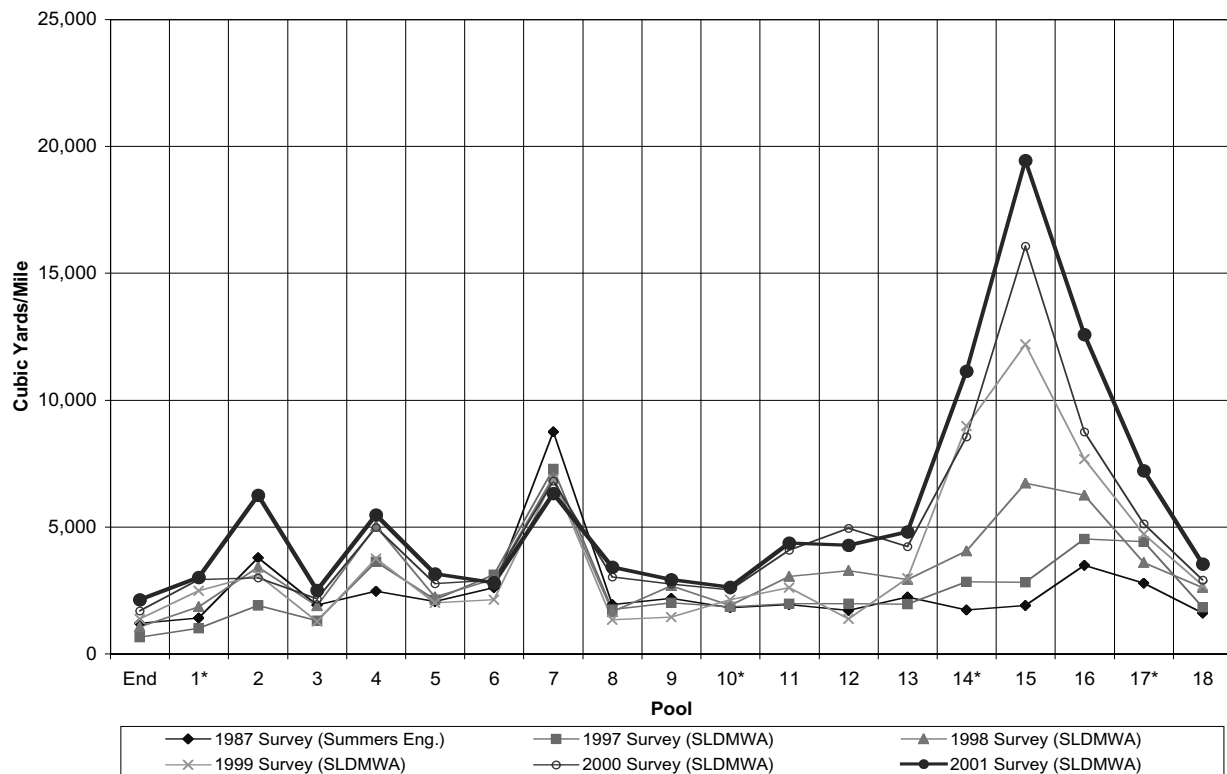


Table 2. Total Suspended Solids

(Monthly Average)			(Monthly Average)		
Date	Site A TSS mg/L	Site B TSS mg/L	Date	Site A TSS mg/L	Site B TSS mg/L
Oct. 1996	92	38	Oct. 1999	73	57
Nov. 1996	59	8	Nov. 1999	62	43
Dec. 1996	77	19	Dec. 1999	26	51
Jan. 1997	135	23	Jan. 2000	67	64
Feb. 1997	57	31	Feb. 2000	250	71
Mar. 1997	94	33	Mar. 2000	148	57
Apr. 1997	111	38	Apr. 2000	134	69
May 1997	101	56	May 2000	165	45
Jun. 1997	107	27	Jun. 2000	136	63
Jul. 1997	136	21	Jul. 2000	99	53
Aug. 1997	140	22	Aug. 2000	120	58
Sept. 1997	111	22	Sept. 2000	59	57
WY 1997 Average	102	28	WY 2000 Average	111	57
Oct. 1997	51	24	Oct. 2000	63	51
Nov. 1997	86	19	Nov. 2000	36	44
Dec. 1997	45	36	Dec. 2000	46	46
Jan. 1998	61	24	Jan. 2001	49	40
Feb. 1998	243	143	Feb. 2001	108	33
Mar. 1998	290	114	Mar. 2001	84	41
Apr. 1998	200	69	Apr. 2001	67	42
May 1998	270	86	May 2001	188	46
Jun. 1998	123	42	Jun. 2001	184	42
Jul. 1998	171	49	Jul. 2001	142	41
Aug. 1998	94	44	Aug. 20 01	116	44
Sept. 1998	37	33	Sept. 2001	65	32
WY 1998 Average	139	57	WY 2001 Average	96	42
Oct. 1998	43	61			
Nov. 1998	28	40			
Dec. 1998	19	30			
Jan. 1999	54	19			
Feb. 1999	149	50			
Mar. 1999	57	33			
Apr. 1999	43	38			
May 1999	97	60			
Jun. 1999	160	68			
Jul. 1999	145	65			
Aug. 1999	166	61			
Sept. 1999	69	71			
WY 1999 Average	86	49			